Combining in situ voltammetry and molecular biology to characterize geomicrobial synergy within diverse aquatic redox gradients

Brian T. Glazer
Institute for Astronomy
University of Hawaii, Manoa
Physical Sciences Building Room 213
2565 McCarthy Mall
University of Hawaii, Manoa
Honolulu, HI 96822
USA
glazer@hawaii.edu

James P. Cowen
Oceanography Department
University of Hawaii, Manoa
USA

Eric Gaidos
Department of Geology and Geophysics
University of Hawaii, Manoa
USA

The work presented represents a combination of recently published advancements made using in situ voltammetric sensors, and their application within the framework of the University of Hawaii's NASA Astrobiology Institute. The research is based on the central hypothesis that phylogenetic, physiological, and biochemical diversity of microbial consortia within aquatic environments reflect the geochemistry of their environment. Microbes can use a wide range of electron acceptors other than oxygen for respiration, and are thereby intricately integral to all the major elemental cycles. An in situ voltammetric analyzer capable of measuring key redox species (oxygen, sulfur speciation and iron speciation) has been deployed in various marine environments including porewaters and the water column. Voltammetric scans are taken using cyclic voltammetry from -0.05 to -1.85 V at 500 mV/sec scan rates (or higher) to measure all detectable redox species simultaneously. The analyzer and the gold/amalgam working electrodes are described by showing existing data from microbial mat porewaters, deep-sea hydrothermal vents, the Black Sea and the Chesapeake Bay. The analyzer is now capable of continuous *in situ* monitoring of chemical parameters and is capable of being placed on moorings. To date, limited studies couple such in situ measurements with microbial community characterization. Future directions include sensor improvement, and more robust coupling of geochemical profiles to molecular phylogenetic and functional analyses within subseafloor and subglacial lake environments.